SECTION 9

POLLUTANT REDUCTION ESTIMATES

9.1 Introduction

EPA obtained data on pollutant loads generated by pharmaceutical manufacturing processes and the ultimate fate of these loads from Detailed Questionnaire responses. Using these data and the treatment performance data presented in 8, the Agency has developed estimates of raw and current pollutant discharge loads from the pharmaceutical manufacturing industry. The Agency also calculated the pollutant discharge loads that would remain after implementation of each of the regulatory options considered.

The following information is presented in this section:

- 9.2 presents the estimated raw loads of regulated pollutants in process wastewaters based on responses to the Detailed Questionnaire;
- 9.3 presents the loads of regulated pollutants currently being discharged based on responses to the Detailed Questionnaire;
- 9.4 discusses estimated end-of-pipe discharge loads for each regulatory option; and
- 9.5 discusses the pollutant load reductions expected through steam stripping and advanced biological treatment.

9.2 Raw Loads

The Agency estimated raw loads, by potentially regulated pollutant, which are generated by pharmaceutical manufacturing processes based on responses to the Detailed Questionnaire. The raw load was estimated as the sum of the discharge load, air emissions from wastewater load, and degraded/destroyed load. These loads from the detailed questionnaire for each facility were summed by pollutant across all facilities within a subcategory group. Table 9-1, located at the end

of this section, lists the estimated raw loads for each pollutant by subcategory and type of discharge.

The raw loads for the Subcategory D indirect dischargers were scaled up according to the methodology discussed in 3.2.4 and presented in Reference (1). This scale-up was used to estimate the total amount of pollutants for all Subcategory D indirect dischargers, including the facilities which were not sent a Detailed Questionnaire. Table 9-2 summarizes the total amount of pollutant load in untreated wastewater from Subcategory B and D indirect dischargers.

9.3 Current Baseline Loads

The current baseline loads are those loads, by potentially regulated pollutant, which are currently discharged by pharmaceutical manufacturing processes to a POTW or to surface water based on responses to the Detailed Questionnaire. Those discharge loads, available from the Detailed Questionnaire for each facility, were summed by pollutant across all facilities within a subcategory group. Table 9-3 lists the current baseline loads for each pollutant by subcategory group and type of discharge.

The current baseline loads for the Subcategory D indirect dischargers were scaled up according to the methodology discussed in 3.2.4 and presented in Reference (1). This scale-up was used to estimate the total amount of pollutants for all Subcategory D indirect dischargers, including the facilities which were not sent a Detailed Questionnaire. Table 9-4 summarizes the total amount of pollutants currently discharged by Subcategory B and D indirect dischargers.

9.4 End-of-Pipe Discharge Loads for Each Regulatory Option

End-of-pipe discharge loads for the BPT, BAT, and PSES regulatory options are presented by subcategory and pollutant in this section. These loads were calculated in the following manner. For each facility, current discharge loads were converted to an estimated current effluent concentration using the pollutant discharge load, facility process wastewater flow, and a conversion factor. For each facility, current estimated effluent concentrations were then

compared to the long term mean concentrations at the end of the treatment train for a particular regulatory option. The lower of these concentrations was used along with the facility flow and an appropriate conversion factor to determine facility specific end-of-pipe discharge loads (2), (3). Loads from all facilities within a subcategory group were then summed to provide the subcategory-wide estimates.

9.4.1 BPT

The regulatory options under BPT address the loads and concentrations of BOD_5, COD, and TSS at Subcategory A, B, C, and D direct discharger facilities. Indirect dischargers are not regulated under BPT.

The regulatory options beyond no revision considered under BPT for Subcategories A, B, C and D direct discharger facilities incorporate advanced biological treatment. Options considered include: 1) no revisions to the existing BPT, 2) revise COD only and clarify cyanide, 3) revise BOD_5 and TSS only and clarify cyanide, and 4) revise BOD_5, COD, and TSS and clarify cyanide. Estimated end-of-pipe discharge loads are presented in Table 9-5 for BOD_5, COD, and TSS removed by advanced biological treatment and the options considered.

9.4.2 BAT

The regulatory options considered under BAT beyond no revision address the loads and concentrations of priority and nonconventional pollutants, including ammonia and cyanide where appropriate.

The regulatory options considered under BAT beyond no revision for Subcategory A and C direct discharging facilities incorporate advanced biological treatment and advanced biological treatment with nitrification. Options considered include: 1) revise COD and clarify cyanide, 2) add organics only, revise COD, and clarify cyanide, and 3) add organics and ammonia, revise COD, and clarify cyanide. Table 9-6 presents estimated end-of-pipe discharge loads for these options. COD end-

of-pipe discharge loads are equivalent to the BPT end-of-pipe discharge loads presented in Table 9-5.

The regulatory option considered under BAT beyond no revision for Subcategory B and D direct discharging facilities incorporates advanced biological treatment. Options considered include: 1) revise COD and withdraw cyanide, and 2) add organics only, revise COD, and withdraw cyanide. Because ammonia is not present at concentrations of concern in Subcategory B and D wastewaters, ammonia nitrification is not included as part of the technology basis for these subcategories. Also, because cyanide is not present at concentrations of concern in Subcategory B and D wastewaters, the regulatory options withdraw the existing cyanide limitations. Table 9-7 presents estimated end-of-pipe discharge loads for this option. COD end-of-pipe discharge loads are equivalent to the BPT end-of-pipe discharge loads presented in Table 9-5.

9.4.3 PSES

The regulatory options considered under PSES beyond no revision address the loads and concentrations of priority and nonconventional organic pollutants and where appropriate, ammonia and cyanide. PSES is being revised for Subcategory A, B, C, and D indirect discharging facilities. Direct dischargers are not regulated under PSES.

The regulatory options beyond no revision considered under PSES for Subcategory A and C indirect discharging facilities include: 1) in-plant steam stripping for organic compounds and ammonia, and clarify cyanide, and 2) in-plant steam stripping for organic compounds and ammonia, plus in-plant cyanide destruction. Table 9-8 presents end-of-pipe discharge loads for these options.

The regulatory option beyond no revision considered under PSES for Subcategory B and D indirect discharging facilities is in-plant steam stripping for organic compounds. Because ammonia is not present at concentrations of concern in Subcategory B and D wastewaters, ammonia is not included as part of the technology option. Also, because cyanide is not present at concentrations of concern in Subcategory B and D wastewaters, the regulatory options withdraw

the existing cyanide limitations. Table 9-9 presents estimated end-of-pipe discharge loads for this option at Subcategory B and D indirect dischargers.

The end-of-pipe loads for the Subcategory D indirect discharging facilities were scaled up according to the methodology discussed in 3.2.4 and in Reference (1). An estimate of the total end-of-pipe discharge loads for the Subcategory D indirect discharging facilities including those not sent a Detailed Questionnaire are presented in Table 9-10.

9.5 Pollutant Load Reduction Estimates

Pollutant load reductions through each regulatory option are discussed in this section. The regulatory options are summarized in Table 7-3 of 7.

9.5.1 BPT

Load reductions through advanced biological treatment for three options are shown in Table 9-11: COD revised; BOD_5 and TSS revised; and BOD_5, COD, and TSS revised.

9.5.2 BAT

Table 9-12 presents load reductions through advanced biological treatment and advanced biological treatment with nitrification for organic pollutants and ammonia under BAT for Subcategories A and C and load reductions through advanced biological treatment for organic pollutants under BAT for Subcategories B and D. These load reductions correspond to the load reduction between current baseline loads and BAT end-of-pipe loads for both A and C; and B and D direct dischargers.

Under BAT, there is also removal of BOD_5 and COD associated with the organics treatment upgrades. The load removals for BOD_5 and COD under BAT are listed in Table 9-13. The first set of removal numbers assume revision of BPT limitations for BOD_5 and COD, with additional incidental COD removal associated with the organics treatment. The second set of removal

numbers assumes no revision of BPT limitations for BOD_5 and COD, and compliance at BAT with a COD limitation equivalent to the BPT COD limitation. Under this approach, there is also incidental BOD_5 removals associated with the COD treatment.

9.5.3 PSES

As discussed in 7 of this document, EPA considered multiple regulatory options of PSES for the four manufacturing subcategories. One option is current treatment (i.e., no revision); this option results in no additional load reductions under PSES. The remaining options are based on in-plant steam stripping. Table 9-14 presents load reductions through in-plant steam stripping for organic compounds and ammonia. These load reductions include the regulated pollutant load reductions achievable by in-plant steam stripping where the in-plant steam strippers see a raw pollutant load prior to air emissions or current on-site treatment.

For the Subcategory A and C PSES option that includes in-plant cyanide destruction, there would be an additional reduction of 1,024 lbs/yr of cyanide.

Load reductions for the Subcategory D indirect dischargers were scaled up according to the methodology discussed in 3.2.4 and presented in Reference (1). An estimate of the total load reductions for the Subcategory D indirect dischargers including those not sent a Detailed Questionnaire are presented in Table 9-15.

Table 9-1

Estimated Raw Loads by Subcategory Group and Discharge Mode (lbs/yr)

Pollutant	A and C Direct Dischargers	B and D Direct Dischargers	A and C Indirect Dischargers	B and D Indirect Dischargers
Conventionals and COD				
BOD_5	90,653,469	1,411,645	NA	NA
COD	197,712,617	2,757,315	NA	NA
TSS	26,416,318	581,627	NA	NA
Priority Organics				
Benzene	1,700	0	121,400	0
Chlorobenzene	10,959	0	84,710	0
Chloroform	404,213	0	488,980	77
o-Dichlorobenzene (1,2-Dichlorobenzene)	0	0	21,499	0
1,2-Dichloroethane	482,499	0	6,552	0
Methylene chloride	7,972,997	25	7,170,355	780,865
Phenol	364,720	1,811	6,693	714
Toluene	3,518,302	0	2,964,665	2,276
Priority Organics Subtotal	**12,755,390**	**1,836**	**10,864,854**	**783,932**
Cyanide	25,651	0	75,065	0
Priority Pollutant Total	**12,781,041**	**1,836**	**10,939,919**	**783,932** [(a)]
Nonconventional Organics				
Acetone	5,079,688	154	13,490,007	1,607,106
Acetonitrile	918,854	0	2,545,953	0
n-Amyl acetate	330,293	0	717,685	824,830
Amyl alcohol	54,000	0	144,619	0
Aniline	0	0	30,551	0
2-Butanone (MEK)	12,868	0	19,578	0
n-Butyl acetate	0	0	415,426	0
n-Butyl alcohol	0	0	977,029	109
tert-Butyl alcohol	86,997	0	212,508	0

Table 9-1 (Continued)

Pollutant	A and C Direct Dischargers	B and D Direct Dischargers	A and C Indirect Dischargers	B and D Indirect Dischargers
Diethylamine	0	0	325,570	0
N,N-Dimethylacetamide	7,460	0	1,379,516	0
N,N-Dimethylaniline	0	0	131,174	0
N,N-Dimethylformamide	4,572,206	0	801,666	0
Dimethyl sulfoxide	87,992	0	819,972	355
1,4-Dioxane	0	0	69,039	0
Ethanol	4,100,897	67,674	8,847,220	2,525,138
Ethyl acetate	3,369,005	0	2,957,822	14,675
Ethylene glycol	41,699	0	326,623	18,061
Formaldehyde	147,220	230	783,013	2,418
Formamide	3,337	0	352,661	0
n-Heptane	0	0	74,346	0
n-Hexane	1,833,105	0	1,566,893	14,624
Isobutyraldehyde	8,501	0	36,479	0
Isopropanol	4,625,059	38,672	9,095,624	853,366
Isopropyl acetate	527,801	0	249,114	225,593
Isopropyl ether	78	0	16,730	350
Methanol	29,442,300	458	21,638,898	99,880
Methyl cellosolve	0	0	1,755,690	0
Methyl formate	607,950	0	28,689	0
Methyl isobutyl ketone (MIBK)	75,130	0	2,416,611	0
Petroleum naphtha	728	0	578,795	146
Polyethylene glycol 600	0	200	37,707	181
n-Propanol	0	0	19,326	0
Pyridine	617,929	0	321,010	1,803
Tetrahydrofuran	135,157	0	816,347	0
Triethylamine	454,280	0	1,693,165	2
Xylenes	724,406	0	153,563	0

Table 9-1 (Continued)

Pollutant	A and C Direct Dischargers	B and D Direct Dischargers	A and C Indirect Dischargers	B and D Indirect Dischargers
Nonconventional Organics Subtotal	**58,256,989**	**107,388**	**75,846,619**	**6,188,637**
Ammonia as N	819,153	28	1,979,257	302
Nonconventional Total	**59,076,142**	**107,416**	**77,825,876**	**6,188,939[(a)]**

(a) Untreated load for facilities for which questionnaire data were available. Estimated total priority and nonconventional pollutant load for all facilities is 7,452,000 lbs/yr.

NA - Not available

Table 9-2

Total Pollutant Load in Untreated Wastewater from Band D Indirect Dischargers

	Subcategory B and D Indirect Dischargers from the Detailed Questionnaire	Subcategory D Indirect Dischargers Without Questionnaire	Total Subcategory B and D Indirect Dischargers
Total Raw Load for Priority and Nonconventional Pollutants (lbs/yr)	6,991,000	461,000	7,452,000

Table 9-3

Current Pollutant Discharge Loads by Subcategory Group and Discharge Mode (lbs/yr)

Pollutant	A and C Direct Dischargers	B and D Direct Dischargers	A and C Indirect Dischargers	B and D Indirect Dischargers
Conventionals and COD				
BOD_5	2,981,441	145,753	NA	NA
COD	29,345,638	544,204	NA	NA
TSS	5,538,216	149,383	NA	NA
Priority Organics				
Benzene	0	0	120,200	0
Chlorobenzene	0	0	5,606	0
Chloroform	4,198	0	177,287	32
o-Dichlorobenzene (1,2-Dichlorobenzene)	0	0	21,499	0
1,2-Dichloroethane	318	0	4,294	0
Methylene chloride	43,518	0	1,198,531	15,595
Phenol	9,000	0	1,206	714
Toluene	8,169	0	257,662	5
Priority Organics Subtotal	**65,203**	**0**	**1,786,285**	**16,346**
Cyanide	42	0	1,084	0
Priority Pollutant Total	**65,245**	**0**	**1,787,369**	**16,346** [(a)]
Nonconventional Organics				
Acetone	21,727	8	3,004,969	43,136
Acetonitrile	6,370	0	423,821	0
n-Amyl acetate	2,493	0	28,509	82,483
Amyl alcohol	53,000	0	143,554	0
Aniline	0	0	4,600	0
2-Butanone (MEK)	143	0	17,283	0
n-Butyl acetate	0	0	415,426	0

Table 9-3 (Continued)

Pollutant	A and C Direct Dischargers	B and D Direct Dischargers	A and C Indirect Dischargers	B and D Indirect Dischargers
n-Butyl alcohol	0	0	664,561	108
tert-Butyl alcohol	2,844	0	95,564	0
Diethylamine	0	0	218,020	0
N,N-Dimethylacetamide	746	0	1,045,358	0
N,N-Dimethylaniline	0	0	18,155	0
N,N-Dimethylformamide	174	0	387,124	0
Dimethyl sulfoxide	5,040	0	745,181	355
1,4-Dioxane	0	0	24,422	0
Ethanol	204,601	7,854	4,368,801	1,283,544
Ethyl acetate	107,183	0	164,241	3
Ethylene glycol	39	0	147,760	18,061
Formaldehyde	1,201	229	310,677	1,083
Formamide	109	0	7,075	0
n-Heptane	0	0	27,894	0
n-Hexane	2,247	0	8,449	100
Isobutyraldehyde	0	0	35,654	0
Isopropanol	181,581	14,841	2,785,586	88,285
Isopropyl acetate	10,556	0	14,809	22,559
Isopropyl ether	1	0	10,963	350
Methanol	725,851	98	12,433,615	44,747
Methyl cellosolve	0	0	445,137	0
Methyl formate	9,843	0	2,773	0
Methyl isobutyl ketone (MIBK)	15,000	0	623,193	0
Petroleum Naphtha	0	0	260,583	0
Polyethylene Glycol 600	0	200	30,839	181
n-Propanol	0	0	11,439	0
Pyridine	50	0	210,186	1,803
Tetrahydrofuran	38,708	0	226,167	0
Triethylamine	11,000	0	407,696	1

Table 9-3 (Continued)

Pollutant	A and C Direct Dischargers	B and D Direct Dischargers	A and C Indirect Dischargers	B and D Indirect Dischargers
Xylenes	2,642	0	24,969	0
Nonconventional Organics Subtotal	**1,403,149**	**23,230**	**29,795,053**	**1,586,799**
Ammonia as N [(b)]	1,128,044	0	433,505	25
Nonconventional Total	**2,531,193**	**23,230**	**30,228,558**	**1,586,824 [(a)]**

(a) Load for facilities for which questionnaire data were available. Estimated total priority and nonconventional pollutant load for all facilities is **2,063,000** lbs/yr.

(b) Load for facilities based on detailed questionnaire loadings, DMR reports, sampling, and self-monitoring data (4).

NA - Not available

Table 9-4

Total Pollutant Load Currently Discharged from B and D Indirect Dischargers

	Subcategory B and D Indirect Dischargers from the Detailed Questionnaire	Subcategory D Indirect Dischargers Without Questionnaire	Total Subcategory B and D Indirect Dischargers
Total Current Baseline Loads for Priority and Nonconventional Pollutants (lbs/yr)	1,603,000	460,000	2,063,000

Table 9-5

Estimated End-of-Pipe BPT Discharge Load

Pollutant	Subcategory A and C BPT Discharge Load (lbs/yr)	Subcategory B and D BPT Discharge Loads (lbs/yr)
No Revisions Option		
BOD_5	2,981,441	145,753
TSS	5,538,216	149,383
COD	29,345,638	544,204
Revise COD Only Option		
BOD_5*	423,766	44,113
TSS	5,538,216	149,383
COD	17,551,857	107,097
Revise BOD_5 and TSS Option		
BOD_5	1,636,442	22,999
TSS	2,945,822	35,861
COD*	28,591,100	192,065
Revise BOD_5, COD and TSS Option		
BOD_5	423,766	22,999
TSS	2,945,822	35,861
COD	17,551,857	107,097

* - These pollutants are incidentally removed under the option.

Table 9-6

End-of Pipe Discharge Loads for Subcategory A and C Facilities Under BAT Options (lbs/yr)

Pollutant	Discharge Loads (lbs/yr)	
	Advanced Biological Treatment	Advanced Biological Treatment with Nitrification
Priority Organics		
Chloroform	118	118
1,2-Dichloroethane	171	171
Methylene chloride	1,663	1,663
Phenol	5	5
Toluene	127	127
Priority Organics Subtotal	**2,084**	**2,084**
Priority Pollutants		
Cyanide	42	42
Priority Pollutant Total	**2,116**	**2,116**
Nonconventional Organics		
Acetone	1,349	1,349
Acetonitrile	5,224	5,224
n-Amyl acetate	877	877
Amyl alcohol	826	826
2-Butanone (MEK)	14	14
tert-Butyl alcohol	2,844	2,844
N,N-Dimethylacetamide	135	135
N,N-Dimethylformamide	35	35
Dimethyl sulfoxide	3	3
Ethanol	10,163	10,163
Ethyl acetate	3,803	3,803
Ethylene glycol	39	39
Formaldehyde	1,038	1,038

Table 9-6 (Continued)

Pollutant	Discharge Loads (lbs/yr)	
	Advanced Biological Treatment	Advanced Biological Treatment with Nitrification
Formamide	12	12
n-Hexane	128	128
Isopropanol	9,940	9,940
Isopropyl acetate	894	894
Isopropyl ether	1	1
Methanol	12,920	12,920
Methyl formate	957	957
Methyl isobutyl ketone (MIBK)	533	533
Pyridine	14	14
Tetrahydrofuran	5,307	5,307
Triethylamine	53	53
Xylenes	60	60
Nonconventional Organics Subtotal	**57,169**	**57,169**
Ammonia	1,128,044	327,130
Nonconventional Pollutant Total	**1,185,213**	**384,299**

Table 9-7

End-of-Pipe Discharge Loads for Subcategory B and D Facilities Under BAT Options (lbs/yr)

Pollutant	Advanced Biological Treatment
Acetone	8
Ethanol	377
Formaldehyde	58
Isopropanol	195
Methanol	98
Polyethylene Glycol 600	154
Nonconventional Pollutant Total [(a)]	**890**

(a) There are no priority pollutant end-of-pipe discharge loads for Subcategory B and D direct discharging facilities.

Table 9-8

End-of-Pipe Discharge Loads for Subcategory A and C Facilities Under PSES Options (lbs/yr)

Pollutant	In-Plant Steam Stripping for Organics	In-Plant Steam Stripping for Organics plus In-Plant Cyanide Destruction
Priority Organics		
Benzene	504	504
Chlorobenzene	473	473
Chloroform	52	52
o-Dichlorobenzene (1,2-Dichlorobenzene)	5,123	5,123
1,2-Dichloroethane	1,767	1,767
Methylene chloride	2,847	2,847
Phenol	1,206	1,206
Toluene	1,358	1,358
Priority Organics Subtotal	**13,330**	**13,330**
Priority Pollutants		
Cyanide	1,084	60
Priority Pollutant Total	**14,414**	**13,390**
Nonconventional Organics		
Acetone	57,617	57,617
Acetonitrile	330,127	330,127
n-Amyl acetate	1,430	1,430
Amyl alcohol	47,093	47,093
Aniline	4,600	4,600
2-Butanone (MEK)	12,452	12,452
n-Butyl acetate	2,008	2,008
n-Butyl alcohol	420,012	420,012
tert-Butyl alcohol	89,831	89,831
Diethylamine	26,816	26,816

Table 9-8 (Continued)

Pollutant	In-Plant Steam Stripping for Organics	In-Plant Steam Stripping for Organics plus In-Plant Cyanide Destruction
N,N-Dimethylacetamide	1,045,358	1,045,358
N,N-Dimethylaniline	1,898	1,898
N,N-Dimethylformamide	387,124	387,124
Dimethyl sulfoxide	745,181	745,181
1,4-Dioxane	24,308	24,308
Ethanol	3,973,339	3,973,339
Ethyl acetate	9,511	9,511
Ethylene glycol	147,760	147,760
Formaldehyde	310,677	310,677
Formamide	1,356	1,356
n-Heptane	612	612
n-Hexane	392	392
Isobutyraldehyde	5,917	5,917
Isopropanol	2,170,103	2,170,103
Isopropyl acetate	4,073	4,073
Isopropyl ether	1,381	1,381
Methanol	9,711,783	9,711,783
Methyl cellosolve	9,577	9,577
Methyl formate	2,773	2,773
MIBK	11,637	11,637
Petroleum Naphtha	260,583	260,583
Polyethylene Glycol 600	30,839	30,839
n-Propanol	6,525	6,525
Pyridine	86,620	86,620
Tetrahydrofuran	6,113	6,113
Triethylamine	21,051	21,051
Xylenes	173	173
Nonconventional Organics Subtotal	**19,968,650**	**19,968,650**

Table 9-8 (Continued)

Pollutant	In-Plant Steam Stripping for Organics	In-Plant Steam Stripping for Organics plus In-Plant Cyanide Destruction
Ammonia	169,164	169,164
Nonconventional Pollutant Total	**20,137,814**	**20,137,814**

Table 9-9

End-of-Pipe Discharge Loads for Subcategory B and D Facilities Under PSES Option (lbs/yr)

Pollutant	In-Plant Steam Stripping for Organics
Priority Pollutants	
Chloroform	0
Methylene chloride	594
Phenol	713
Toluene	5
Priority Pollutant Total	**1,312**
Nonconventional Organics	
Acetone	8,748
n-Amyl acetate	1,385
n-Butyl alcohol	108
Dimethyl sulfoxide	355
Ethanol	1,283,544
Ethyl acetate	1
Ethylene glycol	18,061
Formaldehyde	1,083
n-Hexane	2
Isopropanol	87,985
Isopropyl acetate	786
Isopropyl ether	27
Methanol	44,747
Polyethylene Glycol 600	181
Pyridine	1,803
Triethylamine	1
Nonconventional Organics Subtotal	**1,448,817**
Ammonia	25
Nonconventional Pollutant Total	**1,448,842**

Table 9-10

Total Estimated End-of-Pipe Discharge Loads for Subcategory B and D Indirect Dischargers

	Subcategory B and D Indirect Dischargers With the Detailed Questionnaire	Subcategory D Indirect Dischargers Without Questionnaire	Total Subcategory B and D Indirect Dischargers
Total Priority and Nonconventional Pollutant Discharge Loads under PSES Based on In-Plant Steam Stripping (lbs/yr)	1,450,000	448,000	1,898,000

Table 9-11

Estimated BPT Load Reduction

Pollutant	Subcategory A and C Load Reduction through Advanced Biological Treatment (lbs/yr)	Subcategory B and D Load Reduction through Advanced Biological Treatment (lbs/yr)
Revise COD Only Option		
Incidental BOD_5	2,558,000	102,000
Incidental TSS	0	0
COD	11,794,000	437,000
Revise BOD_5 and TSS Option		
BOD_5	1,345,000	123,000
TSS	2,592,000	113,000
Incidental COD	754,000	352,000
Revise BOD_5, COD and TSS Option		
BOD_5	2,558,000	123,000
TSS	2,592,000	113,000
COD	11,794,000	437,000

Table 9-12

Pollutant Load Reduction Through Advanced Biological Treatment Under BAT for Subcategory A and C and B and D Direct Dischargers (lbs/yr)

Pollutant	Load Reduction for A and C Direct Dischargers	Load Reduction for B and D Direct Dischargers
Priority Organics		
Benzene	0	0
Chlorobenzene	0	0
Chloroform	4,080	0
o-Dichlorobenzene (1,2-Dichlorobenzene)	0	0
1,2-Dichloroethane	147	0
Methylene chloride	41,905	0
Phenol	8,995	0
Toluene	8,042	0
Priority Organics Subtotal	**63,169**	**0**
Priority Pollutant		
Cyanide	0	0
Priority Pollutant Total	**63,169**	**0**
Nonconventional Organics		
Acetone	17,832	0
Acetonitrile	1,146	0
n-Amyl acetate	1,616	0
Amyl alcohol	52,174	0
Aniline	0	0
2-Butanone (MEK)	0	0
n-Butyl acetate	0	0
n-Butyl alcohol	0	0
tert-Butyl alcohol	0	0
Diethylamine	0	0
N,N-Dimethylacetamide	0	0
N,N-Dimethylaniline	0	0
N,N-Dimethylformamide	136	0
Dimethyl sulfoxide	3,712	0
1,4-Dioxane	0	0
Ethanol	195,517	7,477

Table 9-12 (Continued)

Pollutant	Load Reduction for A and C Direct Dischargers	Load Reduction for B and D Direct Dischargers
Ethyl acetate	87,223	0
Ethylene glycol	0	0
Formaldehyde	178	171
Formamide	0	0
n-Heptane	0	0
n-Hexane	241	0
Isobutyraldehyde	0	0
Isopropanol	165,987	14,646
Isopropyl acetate	286	0
Isopropyl ether	0	0
Methanol	712,931	0
Methyl cellosolve	0	0
Methyl formate	8,437	0
Methyl isobutyl ketone (MIBK)	14,462	0
Petroleum Naphtha	0	0
Polyethylene Glycol 600	0	46
n-Propanol	0	0
Pyridine	36	0
Tetrahydrofuran	31,821	0
Triethylamine	0	0
Xylenes	2,582	0
Total Nonconventional Organics Subtotal	**1,296,317**	**22,339**
Ammonia [(a)]	800,913	0
Total Nonconventional Pollutant Total	**2,097,230**	**22,339**

(a) Ammonia is only removed under the BAT option that includes nitrification. Removals for other BAT options are 0 lbs/yr.

Table 9-13

Estimated BAT Load Reduction Under BPT Options

Pollutant	Load Reduction through Advanced Biological Treatment for Subcategory A and C Direct Dischargers (lbs/yr)	Load Reduction through Advanced Biological Treatment for Subcategory B and D Direct Dischargers (lbs/yr)
BPT Revised		
Incidental BOD_5	0	0
Incidental COD	1,215,000	7,000
BPT Not Revised		
Incidental BOD_5	2,558,000	102,000
COD	13,009,000	444,000

Table 9-14

PSES Pollutant Load Reduction Through In-plant Steam Stripping and Cyanide Destruction (lbs/yr)

Pollutant	Load Reduction for A and C Indirect Dischargers	Load Reduction for B and D Indirect Dischargers
Priority Organics		
Benzene	120,896	0
Chlorobenzene	84,094	0
Chloroform	45,219	77
o-Dichlorobenzene (1,2-Dichlorobenzene)	16,376	0
1,2-Dichloroethane	546	0
Methylene chloride	677,934	754,985
Phenol	0	1
Toluene	640,348	1
Priority Organics Subtotal	**1,585,413**	**755,064**
Priority Pollutant		
Cyanide [(a)]	1,024	0
Priority Pollutant Total	159,567	755,064
Nonconventional Organics		
Acetone	2,234,971	1,517,984
Acetonitrile	0	0
n-Amyl acetate	294,153	810,977
Amyl alcohol	0	0
Aniline	0	0
2-Butanone (MEK)	0	0
n-Butyl acetate	412,547	0
n-Butyl alcohol	0	0
tert-Butyl alcohol	0	0
Diethylamine	61,645	0
N,N-Dimethylacetamide	0	0
N,N-Dimethylaniline	0	0
N,N-Dimethylformamide	0	0

Table 9-14 (Continued)

Pollutant	Load Reduction for A and C Indirect Dischargers	Load Reduction for B and D Indirect Dischargers
Dimethyl sulfoxide	0	0
1,4-Dioxane	0	0
Ethanol	110	0
Ethyl acetate	1,693,800	11,639
Ethylene glycol	0	0
Formaldehyde	0	0
Formamide	0	0
n-Heptane	17,502	0
n-Hexane	1,133,860	108
Isobutyraldehyde	29,737	0
Isopropanol	11	300
Isopropyl acetate	9,426	217,732
Isopropyl ether	9,280	323
Methanol	22	0
Methyl cellosolve	978,931	0
Methyl formate	23,283	0
Methyl isobutyl ketone (MIBK)	254,906	0
Petroleum Naphtha	0	0
Polyethylene Glycol 600	0	0
n-Propanol	0	0
Pyridine	0	0
Tetrahydrofuran	91,063	0
Triethylamine	374,837	0
Xylenes	22,140	0
Nonconventional Organics Subtotal	**7,642,224**	**2,559,063**
Ammonia	1,424,865	0
Nonconventional Pollutant Total	**9,067,189**	**2,559,063**

(a) Cyanide is only removed under the PSES option that includes in-plant cyanide destruction. Removals for other PSES options are 0 lbs/yr.

Table 9-15

Total Pollutant Load Reductions from B and D Indirect Dischargers

	Subcategory B and D Indirect Dischargers Submitted in Detailed Questionnaire	Subcategory D Indirect Dischargers Without Questionnaire	Total Subcategory B and D Indirect Dischargers
Total Load Reduction Through In-Plant Steam Stripping for Organic Compounds (lbs/yr)	3,314,000	44,500	3,358,500

REFERENCES

1. Memorandum: Subcategory D Indirect Scale-Up Methodology, from K. Mahsman, Radian Corporation, to the Public Record, September 1994.

2. Memorandum: Final Pollutant Loading Estimates for the Pharmaceutical Manufacturing Industry - Subcategory A/C and B/D Direct and Indirect Discharging Facilities, from K. Mahsman and M. Willett, Radian Corporation, to F. Hund, USEPA/EAD, August 31, 1994.

3. Letter from M. Willett, Radian Corporation, to K. Koon, Versar, December 15, 1994.

4. Memorandum: Ammonia Data Used for Subcategory A/C Direct Facility Loadings, from T. Brenza, Eastern Research Group, to the Public Record, March 1998.